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## Description

The invention the subject of the present application relates to smoking articles.

Proposals have been put forth for smoking articles which in use deliver an aerosol or vapour instead of or in conjunction with smoke from combusted tobacco and/or other smoking material. Such smoking articles may be referred to as 'aerosol generating smoking articles'.

Details of prior proposed aerosol generation smoking articles are to be found in United Kingdom Patent Specifications Nos. 1033674 and 1083761 (Battelle Memorial Institute). Other prior proposed aerosol generation smoking articles are disclosed in United States Patent Specification No. 4714082 (R J Reynolds Tobacco Company).

It is an object of the subject invention to provide improved aerosol generation smoking articles.

EP-A-212234 discloses a smoking article comprising a heating unit, aerosol generation means in flow communication at a first end thereof with the heating unit, and nicotine source means (comprising tobacco) also in flow communication at a first end thereof with the heating unit. A mixing space is provided whereby the aerosol generation means and the nicotine source means are in flow communication at or via respective second ends, and an orifice is in flow communication with the mixing space.

According to the present invention, such a smoking article is characterised in that the orifice comprises at least one velocity acceleration orifice disposed at the downstream end of said mixing space, so as to provide an outlet therefrom, said orifice acting as a capillary press causing nicotine vapour to condense into combination with aerosol particles from said aerosol generation means.

Conveniently, the said at least one velocity accelerating orifice takes the form of one or more openings of small cross-section penetrating a wall member bounding the mixing space.

The wall member may be of plate form.

Preferably, the velocity accelerating orifice opens into a second space.

It is to be understood that although it is preferable for the mixing space and, if present, the second space, to be empty, it is conceivable that one or both of these spaces may contain a loosely packed material.

The smoking article may further comprise a catalytic unit located intermediate said heating unit and said nicotine source means and/or said aerosol generation means.

The catalytic unit preferably comprises a material possessing catalytic activity for the oxidation of carbon monoxide to carbon dioxide. The material may be copper oxide, manganese dioxide or a mixture of both of these. A method of production of a manganese dioxide catalyst for the oxidation of carbon monoxide in tobacco smoke is disclosed in United Kingdom Patent Specifica-

tion No.1315374 (B.A.T.). Suitably, the catalytic material is present in the catalytic unit together with a water binding agent such as silica gel.

The exothermic oxidation reaction of carbon monoxide to carbon dioxide effected by the catalytic unit provides additional heat to gases passing through the catalytic unit from the heating unit.

The smoking article may further comprise alkali source means disposed downstream of said heating unit.

A catalytic unit may be located intermediate the heating unit and said nicotine source means and/or said aerosol generation means.

The alkali source means advantageously comprises a substrate, paper for example, carrying an alkali source material, ammonium carbonate, ammonium bicarbonate or ammonium acetate for example.

The aerosol generation means may comprise an acid, aqueous hydrochloric or acetic acid for example, which is acid reactable with the alkali material to produce micro-crystals which serve as aerosol formation nuclei.

The respective gas flow paths through the aerosol generation means and the nicotine source means are preferably substantially coterminous. Alternatively, the respective gas flow paths through the aerosol generation means and the nicotine source means may be arranged sequentially.

If the aerosol generation means and the nicotine source means are arranged sequentially, either can be disposed closer the heating unit.

An advantageous arrangement of the aerosol generation means and the nicotine source means is for one of these to be disposed annularly about the other.

The heating unit advantageously comprises an ignition portion and a fuel portion. The ignition portion of the heating unit preferably comprises carbonaceous material and a combustion promoter and may also comprise a binder material. The combustion promoter may suitably be potassium nitrate or potassium chlorate, for example. The binder material may be starch, carboxymethyl cellulose or other suitable material. Advantageously the carbonaceous material takes the form of powdered carbon. The fuel portion is also advantageously comprised of carbonaceous material, which material may take the form of powdered carbon, and a suitable binder material such as mentioned above. Other inorganic burn control materials such as perlite and chalk, for example, may also with advantage be present in the fuel portion. The fuel portion may also further comprise a combustion promoter, such as described above, but at a percentage inclusion level less than that of the ignition portion. The heating unit is preferably provided with one or more gas flow passages which extend through the heating unit to aid in the transfer of heat to the aerosol generation means. The heating unit may further, with advantage, be provided with a gas pervious fire break.

The aerosol generation means preferably com-

prises a substrate, such as particulate vermiculite, magnesium silicate or carbon, carrying an aerosol generating substance, such as propylene glycol, glycerol, triethylene glycol or mixtures thereof, which substance is liberated by heat.

Preferably the nicotine source means takes the form of a tobacco-containing section. It is to be understood that the nicotine source means may comprise a sensorily perceived compound(s) in addition to, or in replacement of, nicotine.

Preferably, smoking articles in accordance with the subject invention are of dimensions similar to those of conventional cigarettes and may also comprise a tobacco smoke filtration material, such as cellulose acetate or other suitable materials, at the mouth end thereof.

In order that the subject invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the diagrammatic drawing hereof, which shows a smoking article partly in section and with part of an outer wrapper removed.

The smoking article shown in the drawing, which is an aerosol generation smoking article and which is designated generally by reference numeral 1, comprises, at a forward end thereof, a heating unit 2. Sequentially arranged behind the heating unit 2, in a direction towards the mouth end of the smoking article 1, are a catalytic unit 3, an alkali source means 4, an aerosol element 5 and a mouthpiece 6.

The heating unit 2 comprises a forwardly disposed ignition block 7 of disc configuration, which block 7 is composed of powdered carbon, a binder such, for example, as starch or carboxymethyl cellulose, and a combustion promoter such, for example, as potassium nitrate or potassium chlorate. The heating unit 2 further comprises a cylindrical fuel block 8 composed of powdered carbon and a binder. The fuel block 8 may also comprise a combustion promoter, although at a percentage inclusion level less than that of the ignition block 7. A central gas flow passage 9 and four peripheral gas flow passages 10, of lesser diameter than the passage 9, extend between, and open at, the forward face of the block 7 and the rear face of the block 8.

Also forming part of the heating unit 2 is a gas pervious fire break 11. The fire break 11, which is of disc configuration and is disposed to the side of the block 8 remote the block 7, is formed of, for example, mineral wool or vermiculite.

The catalytic unit 3 comprises a gas pervious cylindrical body of particulate copper oxide in admixture with particulate manganese dioxide and silica gel.

The alkali source means 4 comprises a gas pervious cylindrical body of paper loaded with ammonium carbonate.

The aerosol element 5 comprises a gas pervious cylindrical body 12 of cut tobacco, which body 12 is wrapped in a gas impervious wrapper 13, and a gas pervious annular layer 14 comprised of a particulate substrate of, for example, vermiculite or magnesium sil-

icate, treated with propylene glycol and glycerol. The body 12 of cut tobacco provides nicotine source means and the layer 14 provides an aerosol generation means. The aerosol element 5 further comprises, at forward and rearward ends respectively of body 12 and layer 14, gas pervious retainer discs 15 and 16. The aerosol element 5 also comprises, at the rearward end thereof, a mixing space 17 and a distribution space 18, the space 17 being to the forward side of a transversely disposed plate 19 and the space 18 being to the rearward side of the plate 19. Disposed at the centre of the plate 19 is a circular opening 20 of 0.5 to 1.0 mm diameter, which opening 20 provides a velocity accelerating orifice.

The mouthpiece 6 takes the form of a gas pervious plug of fibrous cellulose acetate.

Items 2 to 6 of smoking article 1 are wrapped in a gas impervious wrapper 21.

In use of smoking article 1, after lighting the ignition block 7 the user draws on the smoking article 1 from the mouth end thereof, thus causing ambient air to flow into the passages 9 and 10 of the heating unit 2. Heated air and hot combustion gases flow sequentially through the fire break 11, the catalytic unit 3, the alkali source means 4 and, in parallel flow paths, through the body 12 of cut tobacco and the annular layer 14.

In passing through the catalytic unit 3 the gases are further heated as a result of the exothermic oxidation reaction of carbon monoxide in the gases to carbon dioxide.

In the passage thereof through the alkali source means 4 the gases pick up ammonia, the presence of which in the gases enhances the mechanisms whereby the gases pick up nicotine from the body 12 of cut tobacco and propylene glycol and glycerol from the layer 14.

As the propylene glycol/glycerol aerosol and the nicotine pass, at elevated velocity, through the opening 20 in the plate 19 nicotine vapour condenses into combination with particles of propylene glycol and glycerol, the opening 20 acting as a capillary press. Thus the user draws from the mouthpiece 6 an aerosol comprising nicotine.

If a volatile flavorant material is deposited at the body 12 of cut tobacco and/or at the layer 14, the aerosol which flows through the space 18 may contain also the flavorant material in the particulate phase of the aerosol.

If hydrochloric acid is deposited at the aerosol element 5, ammonia will react therewith to form a fog of micro-crystals of ammonium chloride, which microcrystals serve as nuclei in the formation of the propylene glycol/glycerol aerosol. Conveniently, the hydrochloric acid or a source thereof, is deposited at the layer 14, in which case it is advantageous that the arrangement is such that ammonia flows through the body 12 of cut tobacco, but not through the layer 14, whereby hydrogen chloride and ammonia do not come into mutual contact until each reaches the mixing space 17. It may thus be the case that the alkali source means is so

dimensioned and disposed as to be in flow communication with the body 12 of cut tobacco, but not to be in flow communication with the layer 14.

#### Claims

1. A smoking article comprising a heating unit (2), aerosol generation means (5) in flow communication at a first end thereof with said heating unit (2), nicotine source means (12) in flow communication at a first end thereof with said heating unit (2), and a mixing space (17) with which said aerosol generation means (5) and said nicotine source means (12) are in flow communication at or via respective second ends thereof, and an orifice (20) in flow communication with the mixing space (17), characterised in that the orifice (20) is at least one velocity accelerating orifice (20) disposed at the downstream end of said mixing space (17), so as to provide an outlet therefrom, said orifice (20) acting as a capillary press causing nicotine vapour to condense into combination with aerosol particles from said aerosol generation means (5).
2. A smoking article according to Claim 1, characterised in that said at least one velocity accelerating orifice (20) takes the form of one or more openings (20) of small cross-section penetrating a wall member (19) bounding said mixing space (17).
3. A smoking article according to Claim 2, characterised in that said wall member (19) is of plate form.
4. A smoking article according to any one of Claims 1 to 3, characterised in that said velocity accelerating orifice (20) opens into a second space (18).
5. A smoking article as claimed in any one of Claims 1 to 4, characterised in the provision of alkali source means (4) disposed downstream of said heating unit (2).
6. A smoking article according to any one of Claims 1 to 5, characterised in that a catalytic unit (3) is located intermediate said heating unit (2) and said nicotine source means (12) and/or said aerosol generation means (5).
7. A smoking article as claimed in Claim 6, characterised in that said catalytic unit (3) comprises a material possessing catalytic activity for the oxidation of carbon monoxide to carbon dioxide.
8. A smoking article according to Claim 7, characterised in that said material is one or both of copper oxide and manganese dioxide.
9. A smoking article according to Claim 7 or 8, characterised in that said catalytic unit (3) further com-

prises a water binding agent.

10. A smoking article according to any one of Claims 5 to 9, characterised in that said aerosol generation means (5) is in gas flow communication with said heating unit (2) via said alkali source means (4).
11. A smoking article according to any one of Claims 5 to 10, characterised in that said alkali source means (4) comprises a substrate carrying an alkali source material.
12. A smoking article according to Claim 11, characterised in that said alkali source material is one or more of ammonium carbonate, ammonium bicarbonate and ammonium acetate,
13. A smoking article according to any one of Claims 1 to 12 characterised in that said aerosol generation means (5) comprises an acid.
14. A smoking article according to any one of Claims 1 to 13, characterised in that the gas flow paths through said aerosol generation means (5) and said nicotine source means (12) are in sequential arrangement.
15. A smoking article according to any one of Claims 1 to 14, characterised in that one of said aerosol generation means (5) and said nicotine source means (12) is disposed annularly about the other.
16. A smoking article according to any one of Claims 1 to 14, characterised in that said nicotine source means (12) comprises a section of tobacco material.
17. A smoking article according to any one of Claims 1 to 15, characterised in that said nicotine source means (12) comprises a sensorily perceived compound(s) in addition to, or in replacement of, nicotine.

#### Patentansprüche

1. Rauchbarer Artikel mit einer Erwärmungs- bzw. Erhitzungseinheit (2), einer Aerosolerzeugungsvorrichtung (5), welche an ihrem ersten Ende mit der Erwärmungs- bzw. Erhitzungseinheit (2) in Strömungsverbindung steht, einer Nikotinquellenvorrichtung (12), welche an ihrem ersten Ende mit der Erwärmungs- bzw. Erhitzungseinheit (2) in Strömungsverbindung steht, und einem Mischraum (17), mit welchem die Aerosolerzeugungsvorrichtung (5) und die Nikotinquellenvorrichtung (12) an oder über ihre jeweils zweiten Enden in Strömungsverbindung stehen, und einer Öffnung (20), welche in Strömungsverbindung mit dem Mischraum (17) ist,

**dadurch gekennzeichnet, daß**

die Öffnung (20) zumindest eine geschwindigkeitsbeschleunigende bzw. Geschwindigkeitsbeschleunigungs-Öffnung (20) ist, die an dem stromabwärtigen Ende des Mischraumes (17) angeordnet ist, um so einen Auslaß des Mischraums zu bilden, wobei die Öffnung (20) als eine kapillare Presse dient, welche bewirkt, daß Nikotindampf in Kombination mit Aerosolpartikeln von der Aerosolerzeugungsvorrichtung (5) kondensiert.

2. Rauchbarer Artikel nach Anspruch 1, dadurch gekennzeichnet, daß die zumindest eine Geschwindigkeitsbeschleunigungsöffnung (20) die Form von einer oder mehreren Öffnungen (20) von geringem Querschnitt aufweist, die ein Wandelement (19) durchdringen, welches den Mischraum (17) begrenzt.

3. Rauchbarer Artikel nach Anspruch 2, dadurch gekennzeichnet, daß das Wandelement (19) plattenförmig ist.

4. Rauchbarer Artikel nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß die Geschwindigkeitsbeschleunigungsöffnungen (20) sich in einen zweiten Raum (18) öffnet.

5. Rauchbarer Artikel nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß eine Alkaliquellenvorrichtung (4) vorgesehen ist, welche stromabwärts von der Erwärmungs- bzw. Erhitzungseinheit (2) angeordnet ist.

6. Rauchbarer Artikel nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß eine katalytische Einheit (3) zwischen der Heizeinheit (2) und der Nikotinquellenvorrichtung (12) und/oder der Aerosolerzeugungsvorrichtung (5) angeordnet ist.

7. Rauchbarer Artikel nach Anspruch 6, dadurch gekennzeichnet, daß die katalytische Einheit (3) ein Material aufweist, das katalytische Aktivität für die Oxidation von Kohlenmonoxid zu Kohlendioxid aufweist.

8. Rauchbarer Artikel nach Anspruch 7, dadurch gekennzeichnet, daß das Material aus Kupferoxid und/oder Mangandioxid besteht.

9. Rauchbarer Artikel nach Anspruch 7 oder 8, dadurch gekennzeichnet, daß die katalytische Einheit (3) weiter ein wasserbindendes Mittel aufweist.

10. Rauchbarer Artikel nach einem der Ansprüche 5 bis 9, dadurch gekennzeichnet, daß die Aerosolerzeugungsvorrichtung (5) in Strömungsverbindung mit der Heizeinrichtung (2) über die Alkaliquellenvorrichtung (4) steht.

11. Rauchbarer Artikel nach einem der Ansprüche 5 bis 10, dadurch gekennzeichnet, daß die Alkaliquellenvorrichtung (4) ein Substrat aufweist, das ein Alkaliquellenmaterial trägt.

12. Rauchbarer Artikel nach Anspruch 11, dadurch gekennzeichnet, daß das Alkaliquellenmaterial eines oder mehrere aus der Gruppe bestehend aus Ammoniumkarbonat, Ammoniumbikarbonat und essigsaurem Ammoniak/Ammoniumazetat ist.

13. Rauchbarer Artikel nach einem der Ansprüche 1 bis 12, dadurch gekennzeichnet, daß die Aerosolerzeugungsvorrichtung (5) eine Säure aufweist.

14. Rauchbarer Artikel nach einem der Ansprüche 1 bis 13, dadurch gekennzeichnet, daß die Gasflußpfade durch die Aerosolerzeugungsvorrichtung (5) und die Nikotinquellenvorrichtung (12) in sequentieller Anordnung ausgelegt sind.

15. Rauchbarer Artikel nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß eine von Aerosolerzeugungsvorrichtung (5) und Nikotinquellenvorrichtung (12) ringförmig um die andere angeordnet ist.

16. Rauchbarer Artikel nach einem der Ansprüche 1 bis 14, dadurch gekennzeichnet, daß die Nikotinquellenvorrichtung (12) einen Abschnitt aus Tabakmaterial aufweist.

17. Rauchbarer Artikel nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß die Nikotinquellenvorrichtung (12) sensorisch wahrnehmbare Verbindungen zusätzlich zu, oder als Ersatz von, Nikotin aufweist.

## Revendications

1. Un article à fumer comprenant une unité chauffante (2), des moyens de génération d'aérosol (5), mis en communication d'écoulement, au niveau d'une première extrémité de ceux-ci, avec ladite unité chauffante (2), des moyens source de nicotine (12) mis en communication d'écoulement, au niveau d'une première extrémité de ceux-ci, avec ladite unité chauffante (2), et un espace de mélange (17) avec lequel lesdits moyens de génération d'aérosol (5) et lesdits moyens source de nicotine (12) sont en communication d'écoulement au niveau ou à travers des deuxième extrémités respectives de ceux-ci, et un orifice (20) mis en communication d'écoulement avec l'espace de mélange (17), caractérisé en ce que l'orifice (20) est au moins un orifice d'accélération de vitesse (20) disposé au niveau de l'extrémité aval dudit espace de mélange (17), de manière à fournir une sortie de cet espace ledit orifice (20) agissant comme presse

- capillaire provoquant la condensation de la vapeur de nicotine en combinaison avec les particules d'aérosols venant des moyens de génération d'aérosol (5).
2. Un article à fumer selon la revendication 1, caractérisé en ce que ledit au moins un orifice d'accélération de vitesse (20) est réalisé sous la forme d'une ou plusieurs ouvertures (20) de petite section transversale, pénétrant dans un organe de paroi (19) délimitant ledit espace de mélange (17). 10
  3. Un article à fumer selon la revendication 2, caractérisé en ce que ledit organe de paroi (19) est de forme plate. 15
  4. Un article à fumer selon l'une quelconque des revendications 1 à 3, caractérisé en ce que ledit orifice d'accélération de vitesse (20) débouche sur un deuxième espace (18). 20
  5. Un article à fumer selon l'une quelconque des revendications 1 à 4, caractérisé par le fait de prévoir des moyens source d'alcali (4), disposés en aval de ladite unité chauffante (2). 25
  6. Un article à fumer selon l'une quelconque des revendications 1 à 5, caractérisé en ce qu'une unité catalytique (3) est située de manière intermédiaire entre ladite unité chauffante (2) et lesdits moyens source de nicotine (12) et/ou lesdits moyens de génération d'aérosol (5). 30
  7. Un article à fumer selon la revendication 6, caractérisé en ce que ladite unité catalytique (3) comprend un matériau présentant une activité catalytique, pour oxyder l'oxyde de carbone en dioxyde de carbone. 35
  8. Un article à fumer selon la revendication 7, caractérisé en ce que ledit matériau est soit de l'oxyde de cuivre, soit du dioxyde de manganèse, ou contient les deux. 40
  9. Un article à fumer selon la revendication 7 ou 8, caractérisé en ce que ladite unité catalytique (3) comprend en outre un agent de fixation d'eau. 45
  10. Un article à fumer selon l'une quelconque des revendications 5 à 9, caractérisé en ce que lesdits moyens de génération d'aérosol (5) sont mis en communication d'écoulement gazeux avec ladite unité chauffante (2) à travers lesdits moyens source d'alcali (4). 50
  11. Un article à fumer selon l'une quelconque des revendications 5 à 10, caractérisé en ce que lesdits moyens source d'alcali (4) comprennent un substrat portant un matériau source d'alcali. 55
  12. Un article à fumer selon la revendication 11, caractérisé en ce que ledit matériau source d'alcali est l'un ou plusieurs des matériaux parmi du carbonate d'ammonium, du bicarbonate d'ammonium, de l'acétate d'ammonium. 60
  13. Un article à fumer selon l'une quelconque des revendications 1 à 12, caractérisé en ce que lesdits moyens de génération d'aérosol (5) comprennent un acide. 65
  14. Un article à fumer selon l'une quelconque des revendications 1 à 13, caractérisé en ce que les voies d'écoulement du gaz, à travers lesdits moyens de génération d'aérosol (5) et lesdits moyens source de nicotine (12), sont agencées de manière séquentielle. 70
  15. Un article à fumer selon l'une quelconque des revendications 1 à 14, caractérisé en ce qu'un desdits moyens de génération d'aérosol (5) et lesdits moyens source de nicotine (12) sont disposés de manière annulaire l'un autour de l'autre. 75
  16. Un article à fumer selon l'une quelconque des revendications 1 à 14, caractérisé en ce que lesdits moyens source de nicotine (12) comprennent une section de matériau contenant du tabac. 80
  17. Un article à fumer selon l'une quelconque des revendications 1 à 15, caractérisé en ce que lesdits moyens source de nicotine (12) comprennent un ou plusieurs composés perceptibles par les sens, en plus, ou en tant que remplacement, de la nicotine. 85

